

# SECTION 5 - ECONOMICS OF SUSTAINABLE DESIGN



Iowa Sustainable Design Initiative



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ECONOMICS OF SUSTAINABLE DESIGN

# Economics of Sustainable Design

## Introduction



Golden Hills Resource Conservation and Development Headquarters, Oakland, Iowa

Just as every building project is unique, so, too, are the costs associated with incorporating sustainable design. One must consider the potential additional cost of added design time, materials, and construction cost. The good news is that there are many solutions that do not add additional cost to a project. Solutions that cost more up-front may offer paybacks (in operational savings, for example) that are acceptable to the building owner. There are solutions, too, that are “the right thing to do” but that may not be practical from an economic perspective. This section provides some suggestions regarding considerations that should be made when addressing the cost of sustainable design. Examples of no-cost solutions, as well as added-cost solutions, are provided. Finally, this section addresses the cost of implementing LEED.

## Key Considerations

Because sustainable design is a relatively new term, designers and building owners alike tend to think of sustainable solutions as added-cost solutions. Until sustainable solutions are instinctively considered in the design process, a few key considerations may be useful.

- Numerous no-cost solutions can be employed for all projects.
- A building owner may be willing to pay more for certain products or services, especially if an associated cost payback can be identified.
- When considering additional cost solutions, consider all economic factors associated with a suggested solution. For example, using an under-floor air system may initially seem to add costs to a project; however, other costs may also be reduced such as downsizing ductwork.
- Remember that sustainable solutions do not need to be “add-ons”. Many are an integral part of the design. For example, locating the mechanical room in the most efficient location, or moving enclosed offices from a building perimeter to the center to allow optimal access to natural light, are design decisions that are difficult to easily delete from a design once included.
- Don’t feel like you have to do it all. Consider what solutions can have the biggest impact.
- Experience is important. The learning curve for sustainable design can be steep. Hiring design professionals with experience can reduce cost.

### Integrated Design Approach

When the Iowa Association of Municipal Utilities building was designed, the integrated team included member utilities, Iowa Energy Center, Polk County Conservation Board, Polk County Soil and Water Conservation District, a prairie restoration team, and Dark Sky Association members.



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- According to the Construction Industry Institute, 80 to 90 percent of facility cost is determined in the first 60 to 90 days of a project design. The ability to influence cost and quality decreases rapidly as a project is designed. If sustainable solutions are considered early in the design process, the probable result is that they will be more economical, and easier to coordinate and construct.

## Additional Design Fees

Sustainable design should increasingly become a natural part of traditional design process. However, several things may increase design time on a sustainable project. An integrated design approach is one of the keys to success on any sustainable design project. This requires that the entire team, including the architect, interior designer, engineers, site designers, consultants, and owner be involved from the very beginning of the project in order to identify sustainable design goals and potential solutions. The owner may also choose to include facilities' staff, building occupants, the contractor, and even members of the community in certain meetings during the early phases of design. This approach may also improve project coordination because more members of the design team have access to project information and input on decisions.

Sustainable design consultants may be retained depending on the owner's goals and expectations. Consultants may have expertise such as energy modeling or commissioning, or special knowledge of particular sustainable technologies or systems (see energy modeling information to the right).

These possibilities should be taken into account and evaluated when developing a budget.

### Energy Modeling

It is highly recommended that new projects include the development of an energy model in the project scope. Energy models simulate a base-case building that meets minimum energy code requirements. More energy efficient options are then modeled to predict operational savings related to enhancements in building design, such as an increase in insulation or glazing, or the addition of sun-shading devices. It is suggested that a professional with such expertise be retained for this work.

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## Additional Cost for Material and System Solutions

Sustainable materials and systems should be considered just as any material or system on a project is considered. Standard questions should be asked, such as:

- is the material or system readily available;
- does it perform equal to or better than other options;
- does it meet project requirements; and
- is more than one manufacturer able to supply the product?

If so, then the impact on the natural environment and indoor environment should be considered. The next step is to evaluate any additional cost. The increasing demand for sustainable products makes sustainable design options continually more affordable.

## Solution Availability

The availability of a sustainable feature or option should be closely examined before proceeding further with its consideration. Some products and materials are difficult to obtain in certain areas. The design professional should determine if the material can be shipped at a reasonable cost and whether or not there is enough material to complete the project without concern. If these types of questions cannot be answered with confidence, then the option should probably be eliminated. For instance, while waterless urinals save significant amounts of water over standard features, they are not approved by many local codes.

## Solution Performance

How well a material or product performs may also be a determining factor in its selection. If an alternative floor tile does not hold up to anticipated traffic, the added cost of removal, floor preparation, new tile, and installation will eradicate any sustainable benefit from the initial decision. In these types of situations, performance will often take precedence over first cost. Find solutions that have existing performance data available.

## Solution Applicability

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Building owners often want to use a sustainable technology simply because they like the idea of using it. For instance, wind turbines may look appropriate situated near a high-tech building, yet unless there is sufficient wind exposure throughout the year, they will not contribute to offsetting grid-supplied electricity. All sustainable design options should be appropriately matched for existing site conditions and program needs for the building.

## Solution Cost

The design team should take a first look at the costs of the sustainable feature and make a preliminary decision about its viability. If the up-front costs are exorbitant, the feature should be eliminated from consideration. Because some technologies are very expensive and/or not fully tested, they often are not an appropriate design choice when cost is initially compared to benefits.

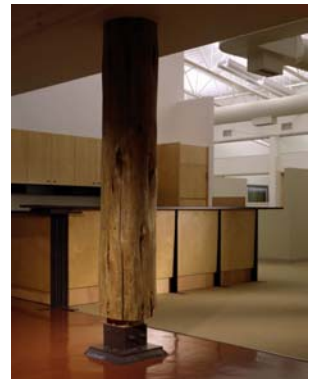
## No Additional Cost Solutions

Sustainable design materials and systems exist that do not add any cost to the project. Some of these are applicable to all project types. For example, low-emitting sealants and adhesives are available that reduce emissions in the indoor environment. There are numerous manufacturers of such products and the cost is no greater than sealants and adhesives with higher emission levels. Many products are available with recycled-content that do not add cost. Ceiling tiles, carpet, and ceramic tile are a few examples. In some regions of the country, the recycling of construction and demolition waste does not add additional cost. Depending on the infrastructure in place, construction waste management can be employed by the contractor with minimal additional effort.

It is suggested that design professionals and building owners develop a standard list of no cost sustainable solutions that can be referred to for all projects.

At the Iowa Association of Municipal Utilities Headquarters, many sustainable solutions were used that did not increase construction cost. They included compost material for soil stabilization; recycled concrete; formaldehyde-free particleboard for casework; and a construction waste management plan. The Iowa Association of Municipal Utilities Headquarters' lobby, shown at right, includes 100 percent recyclable carpet and recycled content drywall. Unnecessary finishes, such as a lay-in ceiling were eliminated, saving additional resources.

At the Golden Hills Resource Conservation and Development Headquarters in Oakland, Iowa, no-cost solutions included using hardboard in lieu of brick, use of indigenous landscaping, pervious



Recycled-content materials were used when constructing the Iowa Association of Municipal Utilities Headquarters in Ames.

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parking, a standing seam roof with high albedo (solar reflectance), and the re-use of office furniture.

### Example: Low-emitting adhesives and sealants

LEED-NC Indoor Environmental Quality Credit 4.1, Low-Emitting Materials, Adhesives and Sealants states: the VOC (volatile organic compound) content of adhesives and sealants used must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168, and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

According to the U.S. Environmental Protection Agency's Indoor Air Quality Glossary, VOCs are compounds that vaporize (become a gas) at room temperature. Common sources which may emit VOCs into indoor air include housekeeping and maintenance products, and building and furnishing materials. In sufficient quantities, VOCs can cause eye, nose, and throat irritations, headaches, dizziness, visual disorders, and memory impairment. Some are known to cause cancer in animals. Still others are suspected of causing, or are known to cause, cancer in humans. At present, not much is known about what health effects occur at the levels of VOCs typically found in public and commercial buildings. This simple, no-cost solution can reduce potential indoor air quality problems. The Golden Hills Resource Conservation & Development Headquarters utilized many low-emitting materials.

The Bay Area Air Quality Management District provides the following VOC limit for sealants. Sealants that meet these VOC limits are readily available at no additional cost from numerous manufacturers.

Sealant	VOC Limit (grams/liter)
Architectural	250
Roadways	250
Sealant	VOC Limit (grams/liter)
Roofing material installation	450
PVC welding	480
Other	420

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## Evaluating Solutions that Cost More

A number of desirable solutions may add cost to a project. Some low-cost solutions may be relatively simple to work into a project budget. For example, replacing particleboard (which contains formaldehyde, a known carcinogen) with wheatboard (an agricultural-based product with no formaldehyde) is usually a very low-cost solution. It is typical, however, to dismiss higher cost solutions due to project budget constraints.

One important element of sustainable design is considering how spending more money up-front may result in accrued benefits over the life of the building. There are many measurable benefits, such as a reduction in operating costs. It is important to understand what type of payback period is acceptable, if any. An acceptable payback may be dependent on numerous factors, including access to funds, and whether the project is public or private. A building owner may not be able to modify an original budget at all. However, there may be some solutions that cost more up-front, but that have a very short payback period.

Other benefits are more difficult to quantify, such as the health benefits resulting from good indoor air quality. Showcasing recycled wood products in a public space may or may not be cost-effective when compared to standard wood products. But the educational and public relations' benefits may be deemed worth the added cost. This is an intangible benefit. Making these types of decisions must be based on building owner and operator values. No formula can decipher this part of the decision process.

At the Iowa Association of Municipal Utilities Headquarters, some features were accepted that added to the construction cost. The result in annual saving is impressive. Metered data shows the building using less than 28,000 Btu/square foot per year, which equates to less than 30 cents per square foot to operate, or a savings of more than 55 percent compared to a similar building with the same climate type.

## Life-Cycle Cost Analysis

Life-Cycle Cost Analysis (LCCA) is a good method to compare various sustainable options. LCCA is an economic method of project evaluation in which all costs arising from owning, operating, maintaining, and disposing of a product are considered important to the decision. LCCA is particularly suited to the evaluation of design alternatives that satisfy a required performance level, but that may have differing investment, operating, maintenance, or repair costs; and possibly different life spans. LCCA can be applied to any capital investment decision, and is particularly relevant when high initial costs are traded for reduced future



Indirect Lighting- Iowa Association of Municipal Utilities; Ankeny, IA

Federal Executive Order 13123, ***Greening the Government Through Efficient Energy Management***, defines life-cycle costs as "...the sum of present values of investment costs, capital costs, installation costs, energy costs, operating costs, maintenance costs, and disposal costs over the lifetime of the project, product, or measure."



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cost obligations. Refer to the resources listed at the end of this section for more information about LCCA.

Once an LCCA is completed so the actual cost is known for competing sustainable design options, the choice is usually easy to make. While the tangible benefits are normally given priority over the intangible, it may be the case that the least expensive option is not the one finally chosen. In the Iowa Association of Municipal Utilities Headquarters, for example, Icynene insulation was installed. The Icynene was \$7,000 more (twice as much as fiberglass batt insulation). The payback, however, was expected to be 3-5 years due to reduced heat loss, a time period acceptable to the building owner.

The resources at the end of this section include suggestions for good LCCA resources.

## The Cost of LEED

### Cost of LEED

Getting a building certified under the LEED Green Building Rating System does add cost to a project.

The cost of LEED certification will vary– achieving LEED certification does cost money, although how much money varies. Many factors affect the cost of LEED such as:

- project complexity– in a highly programmed project such as a laboratory or secured facility, implementing sustainable design may be more difficult;
- project team experience with sustainable design and LEED;
- cost of LEED commissioning and energy performance prerequisite;
- LEED credits pursued– some are more expensive to implement;
- level of certification desired;
- added design time;
- when LEED process is integrated into the design process – early integration costs less; and
- owner/team commitment.

Refer to Appendix A for more information about the cost of LEED.

## Incentives and Financial Assistance

There are a growing number of incentives and financial assistance available for sustainable buildings. It is more common that funds are available for utilizing a specific sustainable solution (fuels cells) or



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realizing a particular end result (reduced reliance on fossil fuels). Also, incentives and assistance can be found at the regional level more often (and often more quickly) than at the national level. Listed on the next few pages are websites and documents that may be helpful in identifying financial assistance and incentives for sustainable design.

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## Related Resources

Contacts	Description	Contact Information
<b>Federal Energy Management Program LCCA Resources</b>	Guidance on meeting LCCA Requirements of Federal Executive Order 13123.	<p>Federal Energy Management Program LCCA Resources</p> <p>EE-2L 1000 Independence Ave., SW Washington, DC 20585-0121 Telephone: (202) 586-5772</p> <p>Website: <a href="http://www.eere.energy.gov/femp/resources/lifecycleguide.html">http://www.eere.energy.gov/femp/resources/lifecycleguide.html</a></p>
<b>The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force</b>	This publication finds that an up-front investment of less than two percent of construction costs yields life-cycle savings of over ten times the initial investment.	<p>The Costs and Financial Benefits of Green Buildings</p> <p>1001 I Street PO Box 4025 Sacramento, CA 95812-4025 Telephone: (916) 341-6000</p> <p>Website: <a href="http://www.ciwmb.ca.gov/GreenBuilding/Design/CostIssues.htm#Cost&amp;Benefit">http://www.ciwmb.ca.gov/GreenBuilding/Design/CostIssues.htm#Cost&amp;Benefit</a></p>
<b>EPA Indoor Air Quality Glossary of Terms</b>	Terms related to indoor air quality provided by the EPA Indoor Air Quality Division.	<p>Environmental Protection Agency</p> <p>Ariel Rios Building 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 Telephone: (202) 272-0167</p> <p>Website: <a href="http://www.epa.gov/iaq/glossary.html">http://www.epa.gov/iaq/glossary.html</a></p>

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### Related Resources (continued)

Contacts	Description	Contact Information
<b>Database of State Incentives for Renewable Energy (DSIRE)</b>	The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy.	Interstate Renewable Energy Council (IREC)  POB 1156 Latham, NY 12110-1156 Telephone: (518) 458-6059  Website: <b><a href="http://www.dsireusa.org/">http://www.dsireusa.org/</a></b>
<b>Funding Green Buildings Customer Newsletter</b>	This is a quarterly publication emailed to clients of Jan McAdams, grant writer for sustainable building grants.	The McAdams Group  1350 East Flamingo, Suite 362 Las Vegas, NV 89119-5294 Telephone: (702) 407-7888  Website: <b><a href="http://www.fundinggreenbuildings.com">http://www.fundinggreenbuildings.com</a></b>
<b>The Iowa Association of Electric Cooperatives</b>	The Iowa Association of Electric Cooperatives (IAEC) provides services to the state's electric cooperatives in the areas of legislation, regulation, safety, communications, education and training, and employee benefits.	IAEC  8525 Douglas, Suite 48 Des Moines, IA 50322 Telephone: (515) 276-5350  Website: <b><a href="http://www.iowarec.org">http://www.iowarec.org</a></b>

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## Related Resources (continued)

Contacts	Description	Contact Information
<b>Iowa Department of Natural Resources Energy Incentives and Assistance</b>	Several state and federal programs can help Iowans adopt energy efficiency and renewable energy technologies. Assistance can be in the form of grant programs, loan programs, tax incentives, expert assistance and more.	Iowa Department of Natural Resources  Wallace Building 502 E. 9th Street, Des Moines, IA 50319-0034 Telephone: (515) 281-5918  Website: <b><a href="http://www.state.ia.us/dnr/energy/MAIN/Incentives&amp;Assistance.html">http://www.state.ia.us/dnr/energy/MAIN/Incentives&amp;Assistance.html</a></b>
<b>Local Utilities</b>	Most utilities offer programs to encourage adoption of energy efficiency measures through design incentives, product rebates, or other incentives.	Be sure to contact the utility serving the location of your project for more details.

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### Related Resources (continued)

Contacts	Description	Contact Information
<b>The Iowa Utility Association (IUA)</b>	The Iowa Utility Association (IUA) was formed to develop, organize and promote improvement in the common business interests and conditions of Iowa's investor-owned electric and natural gas public utilities. The members serve 72 percent of the state's electric customers and nearly 90 percent of its natural gas customers. Each member offers its customers an array of energy efficiency programs, including programs that provide incentives for use of sustainable design and energy efficient systems in new construction.	IUA  321 E. Walnut Street, Suite 300 PO Box 6007 Des Moines, IA 50309 Telephone: (515) 282-2115  Website: <b><a href="http://www.iowautility.org">http://www.iowautility.org</a></b>
<b>US Federal Energy Management Program Building Life-Cycle Cost Programs</b>	FEMP offers many free programs to help building owners determine the financial implications of design decisions before they are chosen.	Website: <b><a href="http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html-blcc">www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html-blcc</a></b>

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